ADMINISTRATIVE NOTE:
NEW REQUIREMENTS/PROCEDURES

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BAA 02-21 PROPOSER INFORMATION PAMPHLET

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The Defense Advanced Research Projects Agency (DARPA) often selects its research efforts through the Broad Agency Announcement (BAA) process. The BAA will be posted directly to FedBizOpps.gov, the single government point-of-entry (GPE) for Federal government procurement opportunities over $25,000. The following information is for those wishing to respond to the Broad Agency Announcement.

Cognitive Information Processing Technology, SOL BAA 02-21, Abstracts Due: April 4, 2003, Proposals Due: Friday, June 6, 2003 POC: Dr. Ronald J. Brachman and Mr. Zachary J. Lemnios, DARPA/IPTO; FAX: (703) 741-7804

The DARPA Information Technology Processing Office (IPTO) is soliciting innovative research proposals in the area of information technology for a new class of cognitive systems that can be characterized simply as follows: a cognitive system is one that, among other things,

- can reason in a variety of ways, using substantial amounts of appropriately represented knowledge;
- can learn from its experiences so that its performance improves as it accumulates knowledge and experience;
- can explain itself and can accept direction;
- can be aware of its own behavior and reflect on its own capabilities; and
- can respond in a robust manner to surprises.

Architecturally, a cognitive information processing system is likely to comprise three types of processes: reactive processes, where system responses are provided with low latency in direct response to inputs; deliberative processes, where planning and other reasoning processes are carried out, including those that deal thoughtfully with natural language and other forms of communication; and reflective processes that operate based on observations made about the system itself. Complete and capable cognitive information processing systems and their underlying processes are likely to be implemented in some combination of novel software and hardware, and are further likely to be augmented with memories of various sorts (long-term, short-term, etc.) and with associated modules for perception and taking action, as appropriate for the end application. Given their abilities to process knowledge and to reflect on their own behavior, cognitive systems might be best characterized as *systems that know what they are doing*.

Despite enormous gains in raw computational power over the last two decades, it is increasingly clear that a revolution in computing foundations is necessary to address the problems of the 21st century. Semiconductor technologists have been doubling the number of transistors on a chip roughly every 18 months (a phenomenon popularly known as “Moore’s

Law"). While there is concern that physical limits of this consistent growth will soon be reached, excellent research continues to be done looking for ways to extend Moore's Law beyond apparent physical limitations, and it seems that with some confidence, we can project that in our lifetimes we will be able to build integrated systems with roughly the number of computing elements that there are in the brains of primates. But there is nothing to indicate that we are on a path to harnessing this raw computing power in the powerful ways that brains do. Critical research must be done to determine how to take advantage of huge numbers of computing elements to produce intelligent processing of the sort that we would call "cognitive." Since the real power of human information processing seems to come from higher level capabilities that use abstraction, mental simulation and planning, hypothetical reasoning, powerful language understanding and generation capabilities, and self-awareness, without an understanding of the architecture for doing such things, no amount of pure computational power will afford us the kind of intelligent computation that we need to face new problems.

Perhaps equally telling is the fact that as each new generation of processor allows us to create larger, more complex systems, we are increasingly being defeated by that complexity. Even the non-scientist knows that the excitement of a new PC wears off quickly as its enormous new hard disk gets eaten up faster than before, and its blazingly fast new processor gets bogged down with all the new features that the computing power tempts us to implement. As systems get larger and more complex, there is evidence that utility and productivity are increasingly falling off the curve that tracks pure processor size and speed. It has become more difficult to program leading-edge high-performance systems (e.g., parallel processors), and the costs of programming and maintaining large software systems are growing at alarming rates. The raw power that has so seductively invited us to build systems of unprecedented size and complexity has led to systems that are dauntingly difficult to debug and test (thus stretching out delivery times), regularly fail in practice, and are increasingly vulnerable to attack. It is evident that investing in more of the same will simply not get us where we need to go.

Substantial change in perspective is necessary to achieve a quantum leap in the robustness, security, and functional capabilities of DoD-scale systems. The focus of our new direction in IPTO is on ways to make systems not simply faster and smaller, but smarter. By taking seriously the notions of reasoning and learning, as well as other aspects of cognitive information processing, we can anticipate a host of potential benefits. If we could truly build systems capable of practical reasoning, learning, and self-awareness, we would expect that such systems would be easier to extend and maintain. For example, we might describe in natural terms a desired extension, and the system would engage us in a dialogue to make sure the right new functionality were created. The system would be aware of its goals and internal state, and in a debugging context could directly help us determine where and why its behavior strayed from the desired. Teams of individual cognitive systems would be able to coordinate in unprecedented ways; among other things, this could eliminate redundancies and gaps in large complex systems, and reduce their overall cost. Intelligent user interfaces could adapt to their users, rather than the other way around.

Cognitive information processing technologies will help us overcome the difficulties and limitations of current approaches and will provide substantial new opportunities in all sectors, encompassing critical defense, industrial and commercial applications.

There are major research challenges in all areas of cognitive information processing technologies. In the context of an autonomous or semi-autonomous cognitive agent, there are a host of capabilities and issues of interest; these include perception; representation and reasoning; learning; communication and interaction; architectures for cognition; and system integration. We are also interested in robust hardware and software infrastructure for building and maintaining cognitive systems and networks of systems. In addition, teams of cognitive (and non-cognitive) systems that can be formed dynamically, and are well coordinated towards a shared set of goals are of direct interest. Each of these areas has important unsolved problems, for example,

- What is the most effective coupling between the perceptual and deliberative components of an artificial knowledge-based system?
- Given the vast amount of raw information that computers sort through almost instantaneously, can the human and animal perceptual systems give us insights into how to find important low-frequency events in huge amounts of data?
- How might an intelligent system use context (physical, conversational, experiential, etc.) to help disambiguate complex natural language expressions and other actions/events appropriately?
- How can plausible but not logically valid reasoning be used in a consistent and pragmatic way to get to reasonable conclusions? Can we build a real-world-scale cognitive system that has a principled foundation for its representation and reasoning capabilities?
- How might it be possible for a system to help its originator in its own debugging? Does there need to be some reliable core or kernel that is provably correct? If so, what is an adequate kernel?
- How might a cognitive system learn the salient things from each experience it has and later use what was learned in an appropriate way to interpret and successfully cope with new situations? How can it find the right remembered experiences to apply to each new situation?
- How can we build systems that effectively keep an eye on themselves? How can an artificial reflective system operate in real time? Is there virtue in allowing reflective processes direct access to internal structures and processes, i.e., true introspection?
- What notions of trust and accountability are critical to the operation of systems with artificial cognitive agents?
- Can insights from cognitive systems yield new general approaches to reliable, fault-tolerant, secure software and hardware systems?
- How do we build systems that can deal with proper prioritization of “standing orders,” given complex and even conflicting goals?
- How can we create teams of agents whose “collective IQ” is at least as high as the “IQ” of the components? Why is group decision-making so poor and how can we improve on human performance in an artificial setting?
- Can we build an “instructable” interface that adapts itself to the desires of the user?

- Can an artificial cognitive system augment a human's capacity to imagine future scenarios and help prepare us better for never-before encountered situations?
- What insights from neuroscience can provide breakthroughs in the building of artificial cognitive systems?
- Can insights from neuroscience and elsewhere inspire mechanisms to allow people to cope with the increasing problem of information overload?
- Can modern "post-PC" distributed computing fabrics facilitate building more robust intelligent systems?
- How can we build networks that are intelligent enough to recognize intrusion attacks and other threats and then through experience learn how to repel subsequent attacks in a general way?
- Can Shannon's theory of "information" be extended to take into account how information is formed and used in the "head" of a cognitive agent, and transmitted to another?

All technologies and approaches to enable the creation and implementation of advanced cognitive information processing systems with significant enhancements in relevant performance metrics are of potential interest under this BAA. Cross-disciplinary approaches that combine both innovative hardware and software to create unique information processing technologies are also of interest. Applications of these new cognitive systems are also of particular interest, in the form of stand-alone systems, mobile platforms, and deeply embedded integrated components.

GENERAL AREAS OF INTEREST

I. Computational Perception: Technologies developed under this area of interest will serve as the information processing interface between sensors or other interfaces to the external environment and the underlying computational processes in a cognitive system. For example, advanced perception technologies could accept streaming sensor data from multiple sources, pre-process and fuse the data with low latency, extracting information content from noise and clutter. The pre-processed data then could be routed to the proper cognitive processes (reflective, deliberative, and reactive). Technologies that provide or enable perception from a wide variety of data sources and physical sensors are of interest. There is interest in approaches that are high performance, but are relatively less complex to implement and for those that are low in power consumption. Also of interest are computational processes that use a cognitive system's knowledge and experience to influence its perceptual capabilities in a way that provides revolutionary improvement in its abilities to detect important objects, events, and situations in its environment.

II. Representation and Reasoning: This area of interest seeks to create pragmatically adequate and mathematically well-founded knowledge representation formalisms and reasoning processes to support the entire range of cognitive information processing demands. Among items of interest are representations for purpose/goals, system structure, and behavior, in order to support reflective processes. Mechanisms that allow a computational system to reflect on its own capabilities and performance and to use such reflection to improve performance and solve more difficult problems are of particular interest.

III. Learning: This area seeks to develop technologies for machines that learn that are sufficient for measurable improvements of basic functionality through the accumulation of experience. Of high interest are those approaches focused on real-time responses and agents with persistent lives that remember where they have been and what they have done.

IV. Communications and Interaction Technology: This area seeks to develop technologies related to advanced interfaces between cognitive systems, legacy systems, and humans. Of special interest are capabilities that allow cognitive systems to be instructed, guided, and persuaded using natural human-oriented communications (e.g., natural language, pictures, gestures).
Natural, integrated multi-modal technology is important to this thrust. User interfaces that can adapt to the interests and needs of the user, either by instruction or by implication, are of interest.

V. Cognitive Architectures and Integrated Cognitive Agents: Systems that integrate the cognitive capabilities of reasoning, learning, explaining, ability to be advised, self awareness and robust coping with surprise are of interest, especially systems that exhibit capabilities substantially beyond those achievable with conventional technology. Significant contributions to the understanding of system architectures adequate to produce functional artificial cognitive systems are also of interest – we seek innovative ideas, concepts, and approaches to determine the most effective machine, information processing system, and network architectures for cognition in different tasks and contexts.

VI. Robust Software and Hardware: This area seeks to develop novel software and hardware platforms that facilitate the building and operation of robust, secure cognitive systems. New technology for innovative fault-tolerant and secure software and hardware infrastructure in the context of cognitive systems and teams of such systems is of interest.

This area includes novel design and implementation approaches to extend cognitive systems technology to a broad user base and the development of associated test beds, distributed software/hardware elements and data sets to validate and extend emerging concepts.

Approaches that show significant new capability in exploiting the current "post-PC" computing opportunities in distributed, pervasive, small computing devices. In addition, this area seeks innovative efforts to develop software engineering technologies and software tools that support the development of cognitive information processing systems.

VII. Cognitive Teams: This area seeks innovative ideas for creating and managing multi-agent systems that can achieve goals in a coordinated way. Such systems can include multiple artificial cognitive agents, humans, and non-cognitive components. Technology that facilitates successful performance of ad hoc teams or networks is of interest. We are also interested in how systems of components can be integrated to realize cognition across a distributed team. Also of interest are methods to optimize performance across the entire multi-agent system.

VIII. Underlying Foundations: This area seeks to establish fundamental scientific and mathematical foundations for cognitive computing areas for which none exist or where those that do are inadequate. Of interest are methods for establishing and assuring trust in cognitive systems; significantly better measures of system-wide robustness; significantly better understanding of accountability in a cognitive systems context; and a firm foundation for artificial reflective systems. Also of interest are technologies for biologically-inspired computing, especially those that will create a radical change in the underlying information processing substrate that is better matched to cognitive computing than the standard Von Neumann model. Of interest are integrated approaches that include appropriate elements of neuroscience and neural systems, semiconductor implementations, and realizable architectures.

PROGRAM SCOPE

Proposed research should investigate innovative approaches and techniques that lead to or enable revolutionary advances in the state-of-the-art. Proposals are not limited to the specific strategies listed above, and alternative visions will be considered. However, proposals should be for research that substantially contributes towards the goals stated. Research should result in prototype hardware and/or software demonstrating integrated concepts and approaches. Specifically excluded is research that primarily results in evolutionary improvement to the existing state of practice or focuses on a specific system or solution. Integrated solution sets embodying significant technological advances are strongly encouraged over narrowly defined research endeavors. Separate proposal should be submitted for areas that are disjointed. Proposals may involve other research groups or industrial cooperation and cost sharing.

SUBMISSION PROCESS

The Defense Advanced Research Projects Agency/Information Processing Technology Office (DARPA/IPTO) requires completion of a **Broad Agency Announcement (BAA) Cover Sheet Submission** for each Abstract/Proposal, by accessing the URL below:

http://www.dyncorp-is.com/BAA/index.asp?BAAid=02-21

After finalizing the **BAA Cover Sheet Submission**, the proposer must print the **BAA Confirmation Sheet** that will automatically appear on the web page. Each proposer is responsible for printing the BAA Confirmation Sheet and attaching it to the "original" and each copy. The Confirmation Sheet should be the first page of the Abstract/Proposal. If a proposer intends on submitting more than one Abstract/Proposal, a unique UserId and password should be used in creating each BAA Cover Sheet. Failure to comply with these submission procedures may result in the submission not being evaluated.

In order to minimize unnecessary effort in proposal preparation and review, proposers are strongly encouraged to submit proposal abstracts, in advance of full proposals.

ABSTRACT FORMAT

Proposers must submit original and **4** hard copies of the abstract *and* **2** electronic copies (i.e., **2** separate disks) of the proposal abstract (in PDF or Microsoft Word 2000 for IBM-compatible format on one 3.5-inch floppy disk or one 100 MB Iomega Zip disk. Each disk must be clearly labeled with BAA 02-21, proposer organization, proposal title (short title recommended) and "Copy <n> of 2". The abstract (original and designated number of hard and electronic copies) must be submitted to DARPA/IPTO, ATTN: BAA 02-21, 3701 N. Fairfax Drive, Arlington, VA 22203-1714, in time to reach DARPA by 12:00 NOON (EST) **Friday, April 4, 2003**. Upon review, DARPA will make a recommendation to offerors either encouraging or discouraging submission of full proposals. However, the decision to submit a full proposal is at the discretion of the proposer.

PROPOSAL FORMAT

Proposers must submit an original and **4** copies of the full proposal *and* **2** electronic copies (i.e., **2** separate disks) of the full proposal (in PDF or Microsoft Word 2000 for IBM-compatible format on one 3.5-inch floppy disk or one 100 MB Iomega Zip disk). Each disk must be clearly labeled with BAA 02-21, proposer organization, proposal title (short title recommended) and "Copy <n> of 2". BAA 02-21, **Cognitive Information Processing Technology** will remain open until 12:00 NOON (EST) **Friday, June 6, 2003**. Thus, proposals may be submitted at any time from issuance of this BAA through **Friday, June 6, 2003.** Proposers should keep in mind that the likelihood of funding is reduced as fiscal year ceilings are reached . DARPA will acknowledge receipt of submissions and assign control numbers that should be used in all further correspondence regarding proposals.

DARPA will attempt to review proposal abstracts within 30 days after receipt, and will make a recommendation encouraging or discouraging formal proposal submissions. Proposal abstracts will be reviewed as they are received. Early submissions are strongly encouraged. Regardless of the recommendation, the decision to propose is the responsibility of the proposer. All submitted proposals will be fully reviewed, regardless of the disposition of the proposal abstract.

The typical proposal should express a consolidated effort in support of one or more technical topic areas. Disjointed efforts should not be included in a single proposal.

Restrictive notices notwithstanding, proposals may be handled for administrative purposes by support contractors. These support contractors are prohibited from competition in DARPA technical research and are bound by appropriate non-disclosure requirements. Input on technical aspects of the proposals may be solicited by DARPA from non-Government consultants /experts who are also bound by appropriate non-disclosure requirements. However, non-Government technical consultants/experts will not have access to proposals that are labeled by their offerors as "Government Only". Use of non-government personnel is covered in FAR 37.203(d).

EVALUATION AND FUNDING PROCESSES

Proposals will not be evaluated against each other, since they are not submitted in accordance with a common work statement. DARPA's intent is to review proposals as soon as possible after they arrive; however, proposals may be reviewed periodically for administrative reasons. For evaluation purposes, a proposal is the document described in PROPOSAL FORMAT Section I and Section II (see below). Other supporting or background materials submitted with the proposal will be considered for the reviewer's convenience only and not considered as part of the proposal.

Evaluation of proposals will be accomplished through a scientific review of each proposal using the following criteria, which are listed in descending order of relative importance:

(1) Overall Scientific and Technical Merit: The overall scientific and technical merit must be clearly identifiable and compelling. The technical concept should be clearly defined, developed and defensibly innovative. Emphasis should be placed on the technical excellence of the development and experimentation approach.

(2) Innovative Technical Solution to the Problem: Proposed efforts should apply new or existing technology in an innovative way such as is advantageous to the objectives. The plan on how offeror intends to get developed technology artifacts and information to the user community should be considered. The offeror shall specify quantitative experimental methods and metrics by which the proposed technical effort's progress shall be measured.

(3) Potential Contribution and Relevance to DARPA/IPTO Mission: The offeror must clearly address how the proposed effort will meet the goals of the undertaking and how the proposed effort contributes to significant advances to the DARPA/IPTO mission.

(4) Offeror's Capabilities and Related Experience: The qualifications, capabilities, and demonstrated achievements of the proposed principals and other key personnel for the primary and subcontractor organizations must be clearly shown.

(5) Plans and Capability to Accomplish Technology Transition: The offeror should provide a clear explanation of how the technologies to be developed will be transitioned to capabilities for military forces. Technology transition should be a major consideration in the design of experiments, particularly considering the potential for involving potential transition organizations in the experimentation process.

(6) Cost Realism: The overall estimated cost to accomplish the effort should be clearly shown as well as the substantiation of the costs for the technical complexity described. Evaluation will consider the value to Government of the research and the extent to which the proposed management plan will effectively allocate resources to achieve the capabilities proposed. Cost is considered a substantial evaluation criterion but is secondary to technical excellence.

The Government reserves the right to select for award all, some, or none of the proposals received. Proposals identified for funding may result in a contract, grant, cooperative

agreement, or other transaction depending upon the nature of the work proposed, the required degree of interaction between parties, and other factors. If warranted, portions of resulting awards may be segregated into pre-priced options.

GENERAL INFORMATION

Abstracts/Proposals not meeting the format described in this pamphlet may not be reviewed. Proposals and proposal abstracts **MUST NOT** be submitted by fax or e-mail; any so sent will be disregarded. This notice, in conjunction with the BAA 02-21 FBO Announcement and all references, constitutes the total BAA. At the DARPA Program Manager's discretion, a Frequently Asked Questions (FAQ) list will be provided. The URL for the FAQ will be specified on the DARPA/IPTO BAA Solicitation page. No additional information is available, nor will a formal Request for Proposal (RFP) or other solicitation regarding this announcement be issued. Requests for same will be disregarded. All responsible sources capable of satisfying the Government's needs may submit a proposal that shall be considered by DARPA. Historically Black Colleges and Universities (HBCUs) and Minority Institutions (MIs) are encouraged to submit proposals and join others in submitting proposals. However, no portion of this BAA will be set aside for HBCU and MI participation due to the impracticality of reserving discrete or severable areas of this research for exclusive competition among these entities.

NEW REPORTING REQUIREMENTS/PROCEDURES: The Award Document for each proposal selected and funded will contain a mandatory requirement for submission of DARPA/IPTO Quarterly Status Reports and an Annual Project Summary Report. These reports, described below, will be electronically submitted by each awardee under this BAA via the DARPA/IPTO Technical – Financial Information Management System (T-FIMS).

The T-FIMS URL will be furnished by the government upon award. Detailed data requirements can be found in the Data Item Description (DID) DI-MISC-81612 available on the Government's ASSIST database (http://astimage.daps.dla.mil/quicksearch/). Sample instructions that specify how information in the DID may be collected (content and frequency requirements) can be found in Appendix A. An outline of T-FIMS report requirements is as follows:

(a) Status Report: Due at least three (3) times per year – Jan, Apr, & Oct
  1) Technical Report
    a) Project General Information
    b) Technical Approach
      - Accomplishments
      - Goals
      - Significant changes / improvements
    c) Deliverables
    d) Transition Plan
    e) Publications
    f) Meetings and Presentations
    g) Project Plans

h) Near term Objectives
2) Financial Report
3) Project Status / Schedule

(b) Project Summary (PSum): Due once each fiscal year in July

1) All Sections of the Status Report
2) QUAD Chart
a) Visual Graphic
b) Impact
c) New Technical Ideas
d) Schedule

PROPOSAL ABSTRACT FORMAT

Proposal abstracts are strongly encouraged in advance of full proposals in order to provide potential offerors with a rapid response and to minimize unnecessary effort. The abstract submission should be clearly marked "PROPOSAL ABSTRACT" and include the BAA confirmation sheet and a technical section, organized as follows:

Section I. The BAA Confirmation Sheet {1 page} described above under "Submission Process" will include the following:

A. BAA number;
B. Technical topic area;
C. Proposal title;
D. Technical point of contact including: name, telephone number, electronic mail address, fax (if available) and mailing address;
E. Administrative point of contact including: name, telephone number, electronic mail address, fax (if available) and mailing address;
F. Summary of the costs of the proposed research, including total base cost, estimates of base cost in each year of the effort, estimates of itemized options in each year of the effort, and cost sharing if relevant;
G. Contractor's type of business, selected from among the following categories: "WOMEN-OWNED LARGE BUSINESS," "OTHER LARGE BUSINESS," "SMALL DISADVANTAGED BUSINESS [*Identify ethnic group from among the following: Asian-Indian American, Asian-Pacific American, Black American, Hispanic American, Native American, or Other*]," "WOMEN-OWNED SMALL BUSINESS," "OTHER SMALL BUSINESS," "HBCU," "MI," "OTHER EDUCATIONAL," "OTHER NONPROFIT", or "FOREIGN CONCERN/ENTITY."

Section II. The technical section of the abstract should include the following:

A. {1 page} Innovative claims for the proposed research. This page is the centerpiece of the abstract and should succinctly describe the unique proposed contribution;
B. {4 pages} Technical rationale, technical approach and constructive plan for accomplishment of technical goals in support of innovative claims and deliverable

products. Include comparison with other ongoing research indicating advantages and disadvantages of the proposed effort.

The total length of the abstract should not exceed six pages including the cover sheet. Submissions must be formatted in Microsoft Word 2000 for IBM-compatible, or PDF, 72 characters to the line, 60 lines to the page. These are the only formats that will be accepted. No formal transmittal letter is required.

PROPOSAL FORMAT

Proposals shall include the following sections, each starting on a new page (where a "page" is 8-1/2 by 11 inches with type not smaller than 12 point) and with text on one side only. The submission of other supporting materials along with the proposal is strongly discouraged. Sections I and II (excluding the submission cover sheet and section M) of the proposal shall not exceed 25 pages. Maximum page lengths for each section are shown in braces { } below.

Section I. Administrative

The BAA Confirmation Sheet {1 page} described above under "Submission Process" will include the following:

A. BAA number;
B. Technical topic area;
C. Proposal title;
D. Technical point of contact including: name, telephone number, electronic mail address, fax (if available) and mailing address;
E. Administrative point of contact including: name, telephone number, electronic mail address, fax (if available) and mailing address;
F. Summary of the costs of the proposed research, including total base cost, estimates of base cost in each year of the effort, estimates of itemized options in each year of the effort, and cost sharing if relevant;
G. Contractor's type of business, selected from among the following categories: "WOMEN-OWNED LARGE BUSINESS," "OTHER LARGE BUSINESS," "SMALL DISADVANTAGED BUSINESS [*Identify ethnic group from among the following: Asian-Indian American, Asian-Pacific American, Black American, Hispanic American, Native American, or Other*]," "WOMEN-OWNED SMALL BUSINESS," "OTHER SMALL BUSINESS," "HBCU," "MI," "OTHER EDUCATIONAL," "OTHER NONPROFIT", or "FOREIGN CONCERN/ENTITY."

Section II. Detailed Proposal Information

This section provides the detailed discussion of the proposed work necessary to enable an in-depth review of the specific technical and managerial issues. Specific attention must be given to addressing both risk and payoff of the proposed work that make it desirable to DARPA.

[IMPORTANT NOTE: WITH THE EXCEPTION OF E, C THROUGH H HAVE BEEN REVISED.]

A. {1 Page} Innovative claims for the proposed research.
This page is the centerpiece of the proposal and should succinctly describe the unique proposed contribution.

B. {1 Page} Proposal Roadmap
The roadmap provides a top-level view of the content and structure of the proposal. It contains a synopsis (or "sound bite") for each of the nine areas defined below. It is important to make the synopses as explicit and informative as possible. The roadmap must also cross-reference the proposal page number(s) where each area is elaborated. The nine roadmap areas are:

1. Main goals of the proposed research (stated in terms of new, operational capabilities for assuring that critical information is available to key users).

2. Tangible benefits to end users (i.e., benefits of the capabilities afforded if the proposed technology is successful).

3. Critical technical barriers (i.e., technical limitations that have, in the past, prevented achieving the proposed results).

4. Main elements of the proposed approach.

5. Rationale that builds confidence that the proposed approach will overcome the technical barriers. ("We have a good team and good technology" is not a useful statement.)

6. Nature of expected results (unique/innovative/critical capabilities to result from this effort, and form in which they will be defined).

7. The risk if the work is not done.

8. Criteria for scientifically evaluating progress and capabilities on an annual basis.

9. Cost of the proposed effort for each performance year.

C. {2 Pages} Research Objectives:

1. Problem Description. Provide concise description of problem area addressed by this research project.

2. Research Goals. Identify specific research goals of this project. Identify and quantify expected performance improvements from this research. Identify new capabilities enabled by this research. Identify and discuss salient features and capabilities of developmental hardware and software prototypes.

3. Expected Impact. Describe expected impact of the research project, if successful, to problem area.

D. Technical Approach:

1. {3 Pages} Detailed Description of Technical Approach. Provide detailed description of technical approach that will be used in this project to achieve research goals. Specifically identify and discuss innovative aspects of the technical approach.

2. {2 Pages} Comparison with Current Technology. Describe state-of-the-art approaches and the limitations within the context of the problem area addressed by this research.

E. {3 Pages} Statement of Work (SOW) written in plain English, outlining the scope of the effort and citing specific tasks to be performed and specific contractor requirements.

F. Schedule and Milestones:

1. {1 Page} Schedule Graphic. Provide a graphic representation of project schedule including detail down to the individual effort level. This should include but not be limited to, a multi-phase development plan, which demonstrates a clear understanding of the proposed research; and a plan for periodic and increasingly robust experiments over the project life that will show applicability to the overall program concept. Show all project milestones. Use absolute designations for all dates.

2. {2 Pages} Detailed Individual Effort Descriptions. Provide detailed task descriptions for each individual effort in schedule graphic.

G. {2 Pages} Deliverables Description. List and provide detailed description for each proposed deliverable. Include in this section all proprietary claims to results, prototypes, or systems supporting and/or necessary for the use of the research, results, and/or prototype. If there are no proprietary claims, this should be stated. The offeror must submit a separate list of all technical data or computer software that will be furnished to the Government with other than unlimited rights (see DFARS 227.) Specify receiving organization and expected delivery date for each deliverable.

H. {2 Pages} Technology Transition and Technology Transfer Targets and Plans. Discuss plans for technology transition and transfer. Identify specific military and commercial organizations for technology transition or transfer. Specify anticipated dates for transition or transfer.

I. {2 Pages} Personnel and Qualifications. List of key personnel, concise summary of their qualifications, and discussion of proposer's previous accomplishments and work in this or closely related research areas. Indicate the level of effort to be expended by each person during each contract year and other (current and proposed) major sources of support for them and/or commitments of their efforts. DARPA expects all key personnel associated with a proposal to make substantial time commitment to the proposed activity.

J. {1 Page} Facilities. Description of the facilities that would be used for the proposed effort. If any portion of the research is predicated upon the use of Government Owned Resources of any type, the offeror shall specifically identify the property or other resource required, the date the property or resource is required, the duration of the requirement, the source from which the resource is required, if known, and the impact on the research if the resource cannot be provided. If no Government Furnished Property is required for conduct of the proposed research, the proposal shall so state.

K. {1 Page} Experimentation and Integration Plans. Offerors shall describe how their results could be integrated with solutions that other contractors are currently developing or are likely to develop. In addition, offerors should identify experiments to test the hypotheses of their approaches and be willing to work with other contractors in order to develop joint experiments in a common testbed environment. Offerors should expect to participate in teams and workshops to provide specific technical background information to DARPA, attend semi-annual Principal Investigator (PI) meetings, and participate in numerous other coordination meetings via teleconference or Video Teleconference (VTC). Funding to support these various group experimentation efforts should be included in technology project bids.

L. {2 Pages} Cost. Cost proposals shall provide a detailed cost breakdown of all direct costs, including cost by task, with breakdown into accounting categories (labor, material, travel, computer, subcontracting costs, labor and overhead rates, and equipment), for the entire contract and for each Government fiscal year (October 1 – September 30). Where the effort consists of multiple portions that could reasonably be partitioned for purposes of funding, these should be identified as contract options with separate cost estimates for each.

M. Contractors requiring the purchase of information technology (IT) resources as Government Furnished Property (GFP) **MUST** attach to the submitted proposals the following information:

1. A letter on Corporate letterhead signed by a senior corporate official and addressed to **<PM's Title & Name>,** DARPA/IPTO, stating that you either can not or will not provide the information technology (IT) resources necessary to conduct the said research.

2. An explanation of the method of competitive acquisition or a sole source justification, as appropriate, for each IT resource item.

3. If the resource is leased, a lease purchase analysis clearly showing the reason for the lease decision.

4. The cost for each IT resource item.

IMPORTANT NOTE: IF THE OFFEROR DOES NOT COMPLY WITH THE ABOVE STATED REQUIREMENTS, THE PROPOSAL WILL BE REJECTED.

Awards made under this BAA may be subject to the provisions of the Federal Acquisition Regulation (FAR) Subpart 9.5, Organizational Conflict of Interest. All offerors and proposed subcontractors must affirmatively state whether they are supporting any DARPA technical office(s) through an active contract or subcontract. All affirmations must state which office(s) the offeror supports, and identify the prime contract number. Affirmations should be furnished at the time of proposal submission. All facts relevant to the existence or potential existence of organizational conflicts of interest, as that term is defined in FAR 9.501, must be disclosed in Section II, I. of the proposal, organized by task and year. This disclosure shall include a description of the action the Contractor has taken, or proposes to take, to avoid, neutralize, or mitigate such conflict.

Section III. Additional Information

A bibliography of relevant technical papers and research notes (published and unpublished) that document the technical ideas, upon which the proposal is based, may be included in the proposal submission. Provide one set for the original full proposal and one set for each of the **4** full proposal hard copies. Please note: The materials provided in this section, and submitted with the proposal, will be considered for the reviewer's convenience only and not considered as part of the proposal for evaluation purposes.

The administrative addresses for this BAA are:

Fax: 703-741-7804 Addressed to: DARPA/IPTO, BAA 02-21
Electronic Mail: baa02-21@darpa.mil
Electronic File Retrieval: http://www.darpa.mil/ipto/Solicitations/index.html

Mail to: DARPA/IPTO
ATTN: BAA 02-21
3701 N. Fairfax Drive
Arlington, VA 22203-1714

Appendix A - Sample Instructions for Application of DiD MI-DISC-81612 or Analog

REMARKS.

- REPORTING PERIOD TERMINOLOGY
  - QUARTERLY REPORTING PERIODS:
    - JUL-SEP: COVERS PERFORMANCE FROM 1 JULY - 30 SEPTEMBER
    - OCT-DEC: COVERS PERFORMANCE FROM 1 OCTOBER - 31 DECEMBER
    - JAN-MAR: COVERS PERFORMANCE FROM 1 JANUARY - 31 MARCH
    - APR-JUN: COVERS PERFORMANCE FROM 1 APRIL - 30 JUNE

- ELECTRONIC SUBMISSION. THE CONTRACTOR SHALL ACCESS THE DARPA EXTRANET REPORTING PAGE TO BE FURNISHED AND ELECTRONICALLY SUBMIT ALL REQUIRED REPORTING INFORMATION ACCORDING TO ALL SPECIFICATIONS BELOW.

- POST-AWARD INITIAL SUBMISSION REQUIREMENT: SUBMIT WITHIN 30 CALENDAR DAYS OF AWARD ALL DATA ITEMS IN 1. PROJECT INFORMATION.

- MINIMAL INITIAL REPORT: IF AWARD OCCURS WITHIN 30 CALENDAR DAYS OF END OF QUARTERLY REPORTING PERIOD SUBMIT DATA ITEMS 2.10 ISSUES OR CONCERNS AND 3.2 PROJECT PLANS, ONLY, IN FIRST REPORT. DUE DATE FOR MINIMAL FIRST REPORT IS WITHIN 15 CALENDAR DAYS OF END OF QUARTERLY REPORTING PERIOD THAT INCLUDES AWARD DATE.

- GENERAL QUARTERLY SUBMISSION REQUIREMENTS
  - FREQUENCY: BLOCK 10. INPUT FOUR (4) TIMES YEARLY, ONCE FOR EACH OF THE QUARTERLY REPORTING PERIODS CITED ABOVE, FOR DURATION OF CONTRACT.
  - REPORTING PERIOD: BLOCK 11. REPORT ON PERFORMANCE DURING THE MOST RECENT QUARTERLY REPORTING PERIOD.
  - DUE DATE: BLOCK 12 AND BLOCK 13. SUBMIT WITHIN FIFTEEN (15) CALENDAR DAYS AFTER THE END OF MOST RECENT QUARTERLY REPORTING PERIOD, BEGINNING XXXXX, I.E.
    - FOR REPORTING PERIOD JUL-SEP, DUE DATE IS OCTOBER 15

- FOR REPORTING PERIOD OCT-DEC, DUE DATE IS JANUARY 15
- FOR REPORTING PERIOD JAN-MAR, DUE DATE IS APRIL 15
- FOR REPORTING PERIOD APR-JUN, DUE DATE IS JULY 15

- QUARTERLY CONTENT REQUIREMENTS
  - IF CURRENT SUBMISSION IS FINAL SUBMISSION FOR THIS CDRL ITEM INCLUDE ALL PARAGRAPHS OF REFERENCED DATA ITEM DESCRIPTION (DID), ELSE
    - FOR THE APR-JUN QUARTERLY REPORT, INCLUDE ALL PARAGRAPHS OF REFERENCED DID
      FOR 3.2.1. PLANNED ACTIVITIES, IN ADDITION TO REPORTING PLANNED ACTIVITIES FOR NEXT QUARTER, INCLUDE A TOP-LEVEL BULLET LIST OF PLANNED ACTIVITIES FOR TIME PERIOD BEGINNING 1 OCTOBER OF CURRENT YEAR AND ENDING 31 DECEMBER OF NEXT YEAR.
    - FOR ALL OTHER QUARTERLY REPORTS, INCLUDE ALL PARAGRAPHS OF THE REFERENCED DID EXCEPT FOR DID PARAGRAPH 1.2 PROJECT DESCRIPTION (AND ALL SUB-ELEMENTS OF 1.2)

- GENERAL MONTHLY SUBMISSION REQUIREMENTS
  - FREQUENCY: BLOCK 10. INPUT TWELVE (12) TIMES YEARLY FOR DURATION OF CONTRACT.
  - REPORTING PERIOD: BLOCK 11. REPORT ON PERFORMANCE DURING PREVIOUS MONTH.
  - DUE DATE: BLOCK 12 AND BLOCK 13. SUBMIT WITHIN FIFTEEN (15) CALENDAR DAYS AFTER END OF PREVIOUS MONTH.

- MONTHLY CONTENT REQUIREMENTS
  - FOR DURATION OF CONTRACT, SUBMIT REFERENCED DID ITEMS 2.3 INCURRED EXPENSES THIS PERIOD AND 2.4 INCURRED EXPENSES TO DATE, AS LUMP SUM TOTAL ONLY.

- CONCURRENT SUBMISSION REQUIREMENTS
  - FOR DURATION OF CONTRACT SUBMIT 2.5 INVOICES THIS PERIOD AND 2.6 INVOICES TO DATE, AS INVOICES ARE SUBMITTED FOR PAYMENT. PERIOD IN 2.5 DENOTES TIME SINCE LAST SUBMISSION OF INVOICE(S).

- FORMAT
  - GENERAL FORMAT INSTRUCTIONS: COMPLY WITH ALL INSTRUCTIONS DELINEATED ON THE DARPA EXTRANET REPORTING PAGE.

- SPECIAL FORMAT INSTRUCTIONS: SUBMIT 3.1.7, PUBLICATIONS THIS PERIOD, IN ADOBE ACROBAT (PDF) FILE FORMAT. SUBMIT 1.2.3.1, SCHEDULE GRAPHIC IN EITHER POWERPOINT (PPT), JPG, TIFF, OR PDF FILE FORMAT. SUBMIT 1.2.6, QUAD-CHART, IN MICROSOFT POWERPOINT (PPT) FILE FORMAT.

- INPUT OF PROPRIETARY INFORMATION:
  - PROPRIETARY INFORMATION MAY BE ENTERED ONLY FOR THE FOLLOWING ITEMS AND ONLY IN THOSE AREAS DESIGNATED FOR SUCH INPUT ON THE DARPA EXTRANET REPORTING PAGE
    - 1.2.2.1 DETAILED DESCRIPTION OF TECHNICAL APPROACH
    - 1.2.2.2 COMPARISON WITH CURRENT TECHNOLOGY
    - 3.1.2 TECHNICAL ACCOMPLISHMENTS THIS PERIOD
    - 3.2.1 PLANNED ACTIVITIES

- CLASSIFICATION: THE ENTIRE REPORT SHALL BE UNCLASSIFIED.

- INCLUDE THIS R&D PROJECT SUMMARY ON THE FINAL DD FORM 250.